

Impact of the Endophyte on Animal Production¹

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Tall fescue is productive and well adapted to the soils and climate in a region commonly referred to as the “fescue belt”, which overlays the transition zone between the temperate northeast and subtropical southeast. Persistence of the grass under low input management is attributed to a fungal endophyte that infects most fescue plants and produces alkaloids that impart tolerance to heat, drought, and grazing stresses. Unfortunately, the endophyte also produces ergot alkaloids that can induce toxicosis. Signs of “fescue toxicosis” are elevated body temperature and respiration rate, retention of winter hair coats through the summer months, hormonal imbalances, and reduction in dry matter (DM) intake (Strickland et al., 1993). Consequently, ingested ergot alkaloids adversely affect calf growth rates, conception and pregnancy rates, and milk production (Porter and Thompson, 1992).

A primary of ergot alkaloids is on the persistent constriction of blood flow to peripheral tissues, and a reduction in certain hormones involved in growth, pregnancy, and lactation. Vascular constriction reduces an animal's ability

to dissipate body heat via skin, making them vulnerable to severe heat stress (Strickland et al., 1993). Furthermore, poor blood flow in cold air temperatures can lead to “fescue foot”, a chronic condition that causes lameness and necrosis of peripheral tissues (hoofs, tail, and ear tips). Ergot alkaloids also reduce circulating hormones, such as prolactin (Porter and Thompson, 1992; linked to milk production); progesterone (Jones et al., 2003); linked to pregnancy); and luteinizing hormone (Porter and Thompson, 1993; linked to conception). A less recognized problem of cattle grazing toxic fescue is the nutrient deficiencies that can develop from low DM intakes.

Hoveland (1993) estimated that the toxic endophyte annually costs the U.S. beef industry \$354 million in reduced calf numbers and \$255 million in reduced weaning weights. Adjustment of these estimates to 2006 calf prices shows costs of \$468 million in reduced calf numbers and \$338 million in reduced weaning weights. Therefore, the annual cost of the toxic endophyte to the beef industry has increased to a total cost of approximately \$800 million.

¹Mention of trade names or commercial products in the article is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the USDA.

Cow-Calf Production

Reduced calving rates for cow herds grazing toxic endophyte fescue have been well documented. Schmidt et al. (1986) found 96% conception for heifers grazing tall fescue with a low endophyte infection percentage while there was 55% conception for those grazing tall fescue with a high level of infection. Calving rates were observed by Gay et al. (1988) to be 94.6 and 55.4% for cows grazing uninfected and infected tall fescue, respectively. Reductions in circulating prolactin, progesterone, and luteinizing hormones in cows grazing toxic fescue have been implicated in impaired reproductive performance.

Suckling calf ADG and weaning weights on toxic fescue pastures can be less than those achieved on endophyte-free pastures. Watson et al. (2004) reported lower ADG and weaning weights for steer calves weaned on toxic fescue pastures (ADG = 2.14 lb/day, weaning weight = 500 lb) than those weaned on a tall fescue infected with a novel nontoxic endophyte (Jesup MaxQ) that does not produce ergot alkaloids (ADG = 2.54 lb/day, weaning weight = 562 lb). Low milk production is a major limiting factor of reduced weaning weights on toxic fescue. Angus cows grazing toxic fescue have shown a 43% decrease in milk yield and lower milk fat compared to those grazing common bermudagrass (Brown et al., 1996).

Creep-feeding or creep-grazing of higher quality, nontoxic forages can increase weaning weights on toxic fescue pastures. Cow-calf producers also have options of using fall calving or early weaning to avoid warmer air temperatures during the summer.

Overseeding clovers or feeding co-product feeds can improve cow body condition and dilute dietary alkaloid concentrations to improve reproductive performance. Planting nontoxic, novel endophyte fescues also is an option in improving reproductive performance and weaning weights.

Stocker Calf Production

Poor weight gain and ill-thriftiness of calves that graze toxic tall fescue has resulted in the grass not being used to any extent for stocker production. Paterson et al. (1995) concluded that average daily gains (ADG) on toxic fescue range from 0.40 to 1.3 lb/day. It is doubtful that toxic tall fescue pastures can support ADG > 1.75 lb/day to meet target body weights. For growing 500 lb stockers to 750 lb body weights on pasture, it takes 192 days to accomplish this target body weight if an ADG of 1.3 lb/day is achieved. An ADG of 0.75 lb/day with these same stockers would require 333 days. Therefore, weight gain efficiency with E+ fescue is typically too low to generate profitable stocker production.

A problem with achieving acceptable ADG is when grazing is extended into the late spring and summer when warmer air temperatures and humidity induce heat stress. Aldrich et al. (1993) observed a 22% decline in DM consumption of E+ fescue with an air temperature of 90°F. Grazing frequency declined for cattle grazing toxic tall fescue in the afternoon and evening hours when daily mean air temperatures exceeded 76°F (McClanahan et al., 2008). This decrease in DM intake is associated with heat stress as cattle become less able to adjust to high air

temperatures. Further, the typical rough hair coat of fescue cattle during the summer has an insulation effect on elevated core body temperatures. Another problem for fescue cattle in dissipating body heat is a reduction in sweating and evaporative cooling of skin (Aldrich et al., 1993; McClanahan et al., 2008), which is likely due to constricted blood flows to sweat glands.

There are options in “managing around” fescue toxicosis to improve the profit potential of stocker production on toxic endophyte fescue. Overseeding clovers or feeding by-product feeds can generate acceptable ADG. Clovers also add fixed nitrogen, via bacteria that colonize in their roots, to the soil as a cost effective alternative to commercial nitrogen. Aiken et al. (2010) demonstrated a 32% increase in ADG and a reduction in the severity of fescue toxicosis by feeding pelleted soybean hulls at a consumption of 5 lb/steer/day. Grazing nontoxic novel endophyte fescue, particularly during periods of warm temperatures, also can provide ADG to efficiently meet targeted body weights

Feedyard Performance

There is concern that poor performance and thriftiness of calves exhibiting toxicosis can carry-over into the

feedyard. Experiments have shown rapid recovery from toxicosis based on rectal temperatures and prolactin concentrations (Aiken et al., 2008), and urinary alkaloid concentrations (Stuedemann et al., 1998), but rapid and complete clearance of alkaloids from the animal body is doubtful because they are bound in animal tissues. Unpublished data collected with steers that were removed from toxic endophyte-infected or endophyte-free fescue pastures and placed on nontoxic diets in pens showed that rectal temperatures in steers grazed on toxic endophyte fescue took approximately 30 days to decline to those similar to steers grazed on endophyte-free fescue.(Figure 1). However, in the next year with cooler air temperatures, rectal temperatures in steers grazed on toxic endophyte-infected pasture declined rapidly and were similar to those similar to the endophyte-free steers in 8 to 10 days. Fescue cattle apparently can effectively dissipate body heat when they are in milder air temperatures. Therefore, feedyard cattle that were background on toxic endophyte-infected fescue can be vulnerable to heat or cold stress for a certain period of time, which should be taken in consideration when deciding times of the year to transport fescue cattle to the feedyard.

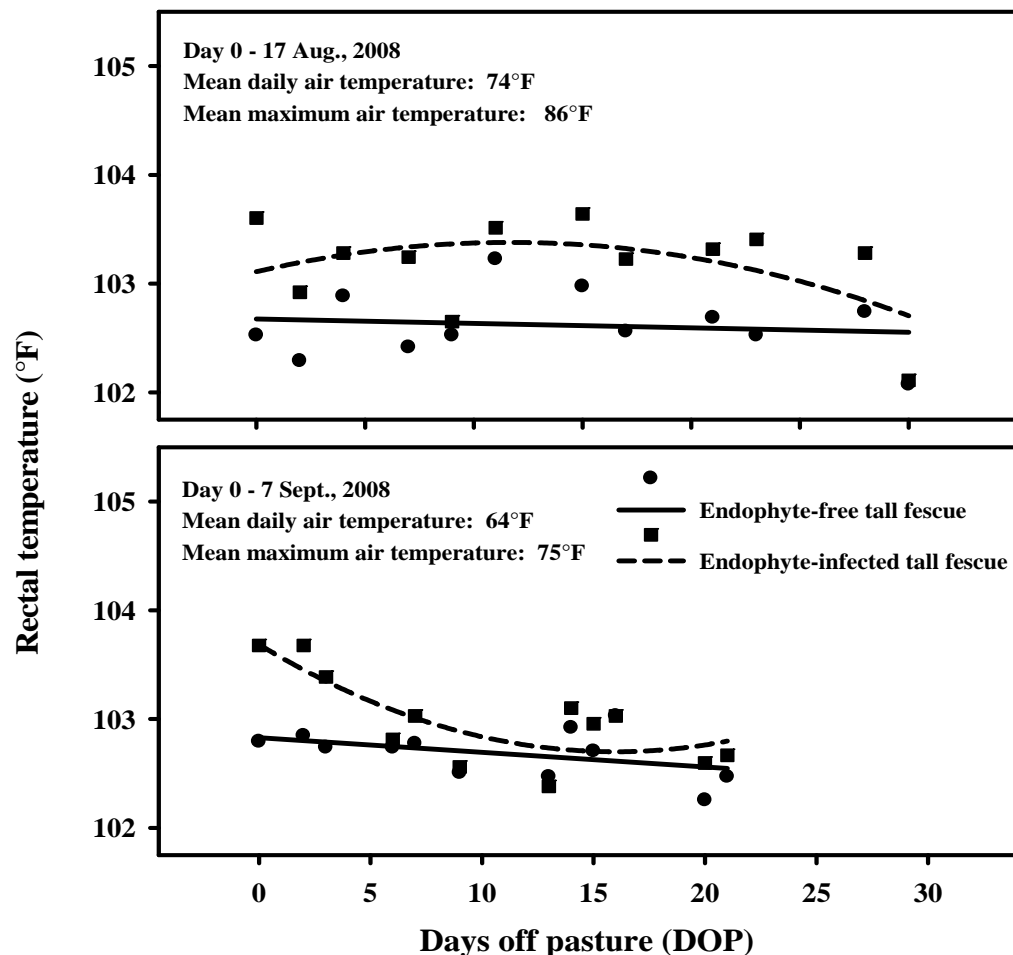


Figure 1. Trends in rectal temperature over days after steers are removed from endophyte-infected pasture and fed a corn silage-soybean hull diet. Data is for 2 monitoring periods presenting different air temperature conditions.

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